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TWO-DIMENSIONAL READOUT OF A DRIFT CHAMBER USING CURRENT DIVISION

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As part of a continuing program to upgrade the Fermilab Multiparticle Spectrometer, a prototype drift chamber with two dimensional readout has been built and tested. The chamber size is 6 feet by 3 feet with all wires stretched in the longer dimension. This length corresponds approximately to the longest wires needed in the MPS with its present magnet and building size. All sizes were chosen as 1.6" corresponding to about 800 ns maximum drift time using 80% A, 20% CO_2 mixture (Fig. 1). The drift time is measured using digitizers designed by T. Droege[1]. The intrinsic resolution possible using these modules is about 100 microns.

In our tests we have concentrated on reading out the coordinate along the wire. Several schemes are under development by various groups for achieving two-dimensional readout. We have chosen the current division scheme and have relied considerably on the pioneering work of Foeth, et al[2]. The anode wire is 25 micron gold-plated tungsten with a resistance of about 180 Ω. Both ends of the wire are capacitively coupled into a common base amplifier followed by a 733 wide band amplifier with a gain of 100 (Fig.2). These pulses are driven through 50 Ω cable to LeCroy 2249 A ADC's.

Using a Ru^{106} source and a scintillator trigger, we have measured the resolution along the wire as $\sigma = ½"$. Figure 3 shows the ratio of q^{top}/q_{bottom} for source locations separated by 4" (along a 72" wire). As the source is moved to either end of the wire resolution worsens. Figure 4 shows top pulse height versus bottom pulse height for ten source positions from about the center of the chamber to one end. We have tested the current division readout in the MPS beam where the trajectories can be localized better than with a beta source. Figure 5 shows the top versus bottom pulses near the center of the chamber. Using this beam a resolution of $\sigma = ¼"$ was obtained.

References

Droege, IEEE Transactions on Nuclear Science, Vol. NS23, No. 1, p.248, Feb. 1976

Foeth, et al. NIM 109 (1973) 521

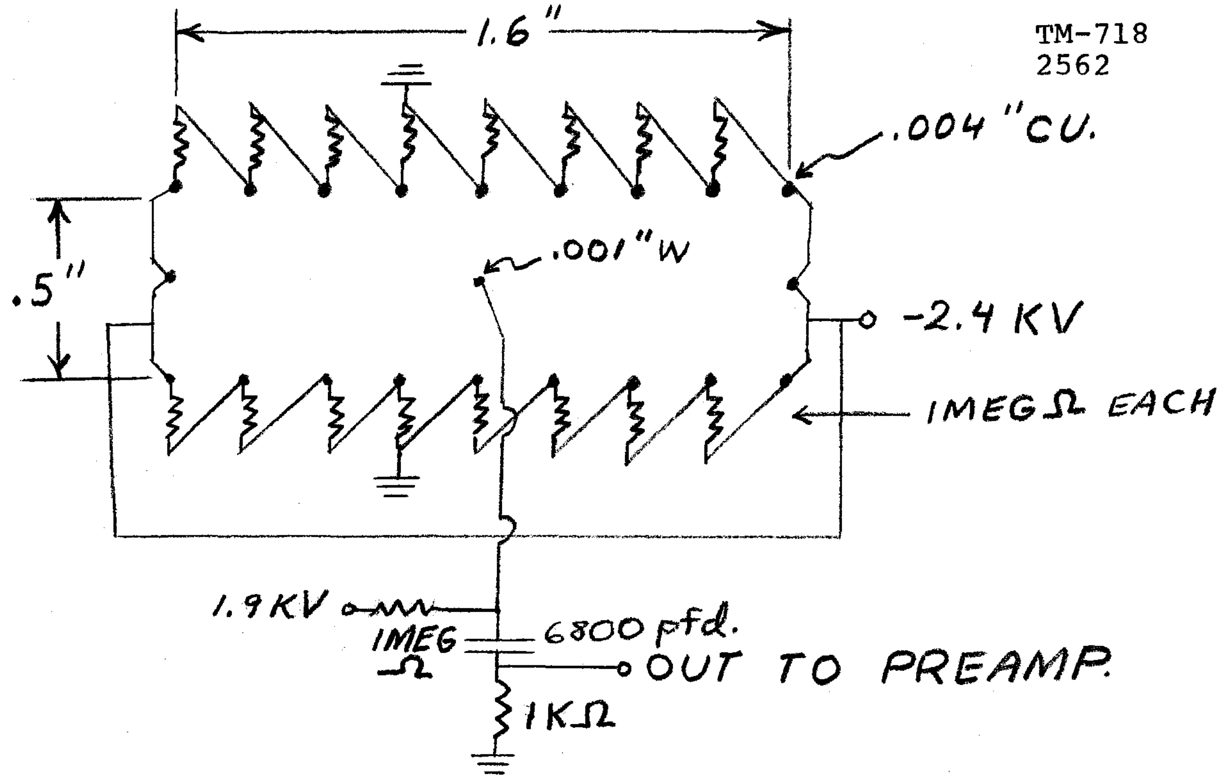

FIG. 1 CELL STRUCTURE

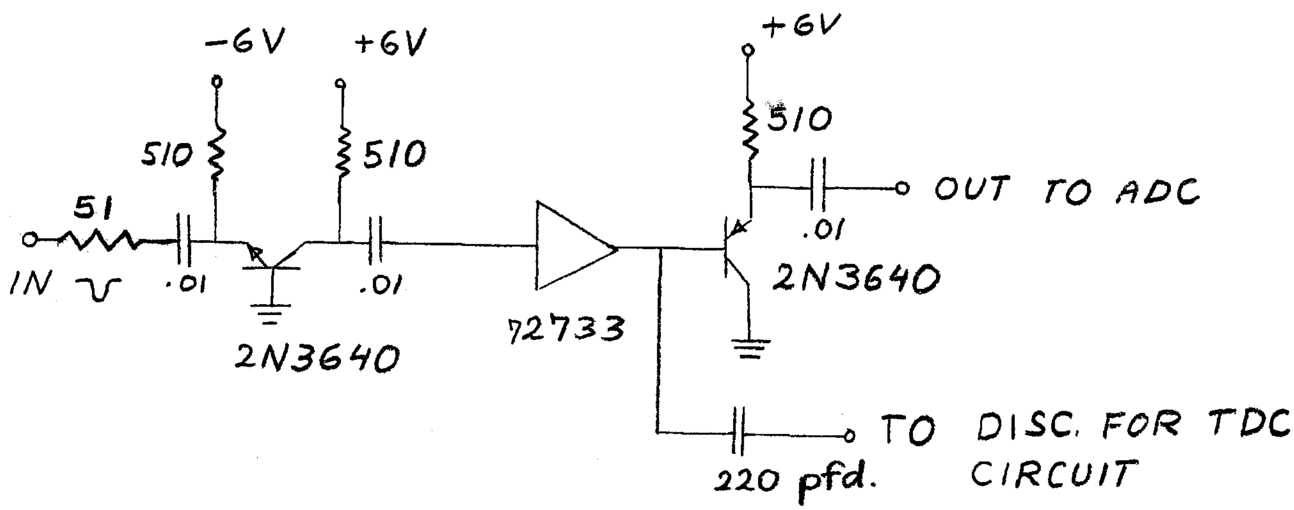

FIG. 2 PREAMPLIFIER

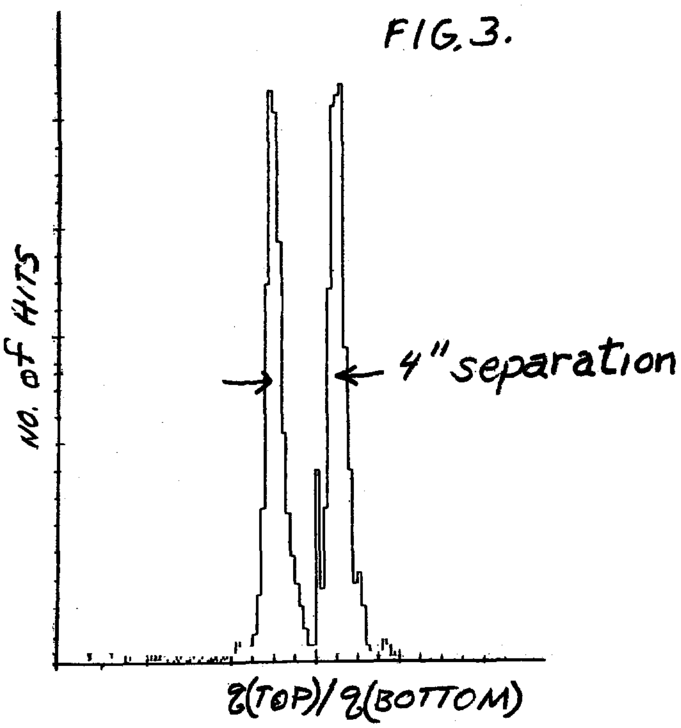

FIG. 3.

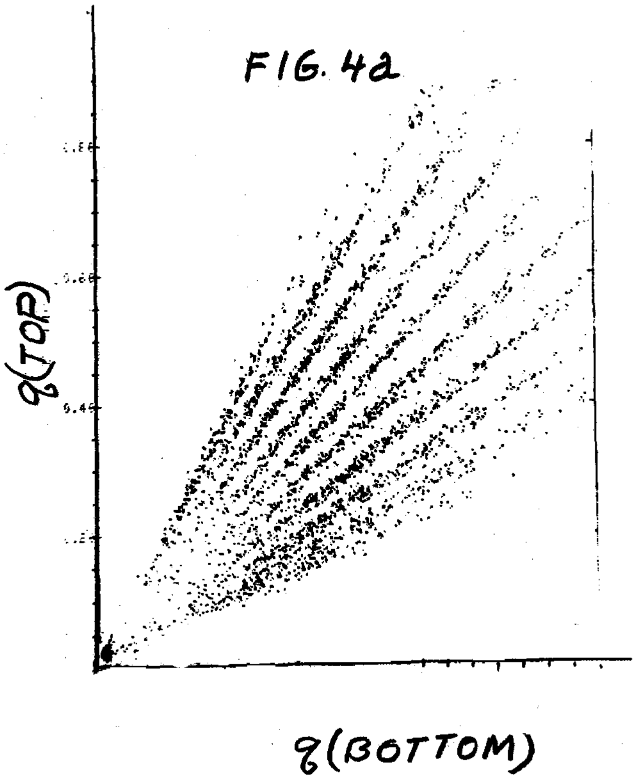

FIG. 4a

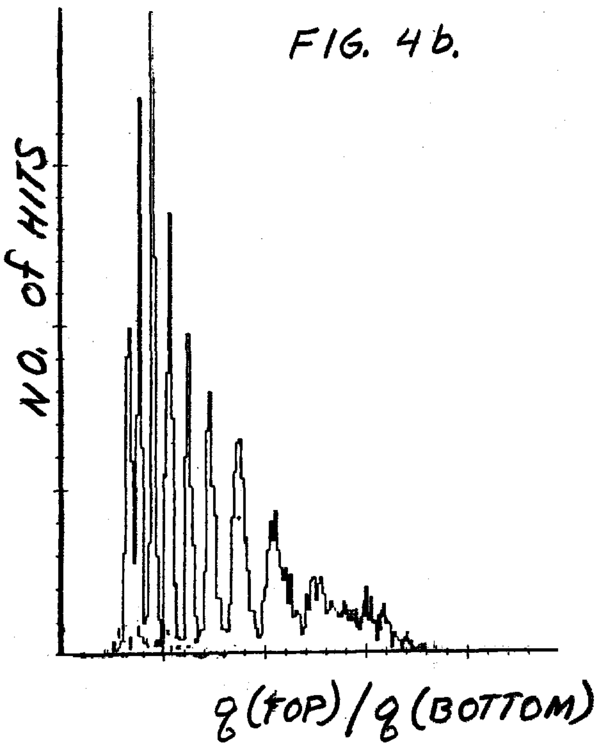

FIG. 4b.

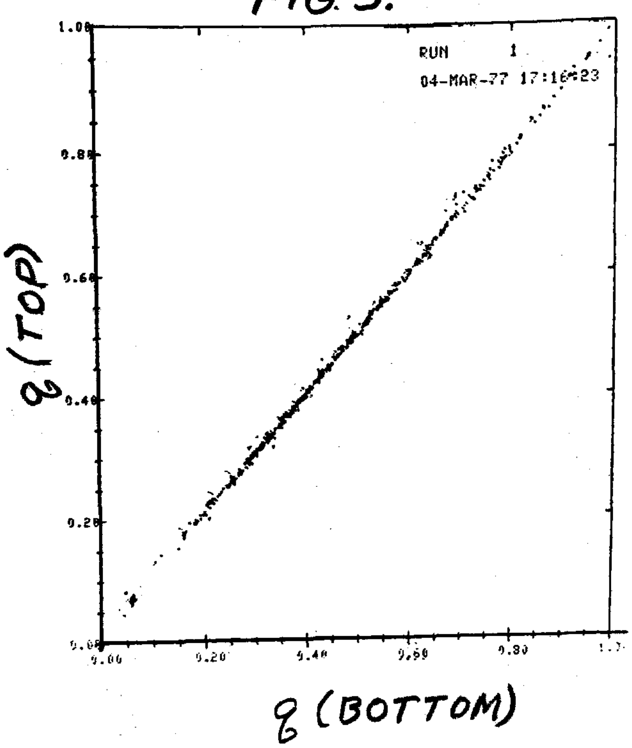

FIG. 5.